

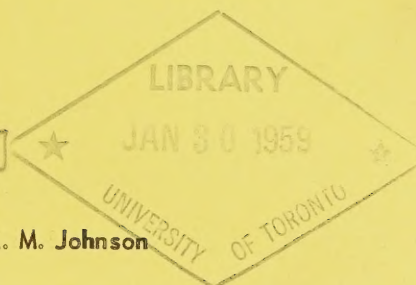
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Canada, Agriculture, Department of
"Marketing Service, Economics Division

CROP PRODUCTION REQUIREMENTS IN MANITOBA

Machinery, Labor, and Materials

[by] ★



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Economics Division

Marketing Service

Canada Department of Agriculture



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MANITOBA

(SOUTHERN PORTION)

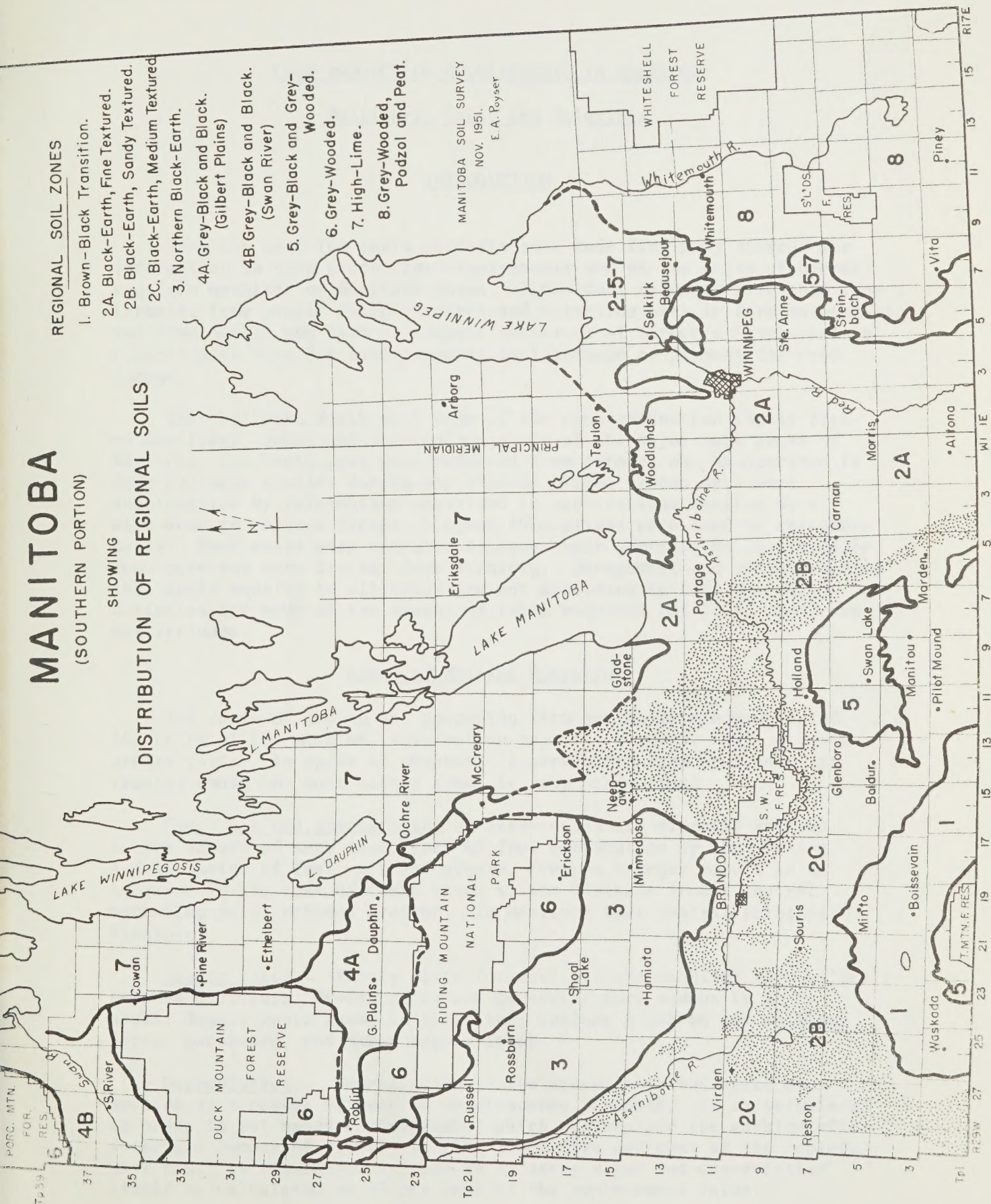
SHOWING

DISTRIBUTION OF REGIONAL SOILS

REGIONAL SOIL ZONES

1. Brown-Black Transition.
- 2A. Black-Earth, Fine Textured.
- 2B. Black-Earth, Sandy Textured.
- 2C. Black-Earth, Medium Textured.
3. Northern Black-Earth.
- 4A. Grey-Black and Black.
(Gilbert Plains)
- 4B. Grey-Black and Black.
(Swan River)
5. Grey-Black and Grey-Wooded.
6. Grey-Wooded.
7. High-Lime.
8. Grey-Wooded,
Podzol and Peat.

MANITOBA SOIL SURVEY
NOV. 1951.
E. A. Royser



CROP PRODUCTION REQUIREMENTS IN MANITOBA

Machinery, Labor and Materials

INTRODUCTION

Over the past few years requests have come from many sources for information on crop production requirements and on the costs of operating farm machines on Manitoba farms. Individual requests have come from farmers, from people doing research and extension work in farm management, and from people who have to compute estimates of farmer's investment in a particular crop for such purposes as insurance or payment for crop damage.

This bulletin deals with some of the crop production inputs such as machinery, labor and materials, in six of the major soil areas of Manitoba. The basic data were obtained from farmers who co-operated in farm business studies during the 1952-56 period. These data were supplemented by information contained in publications dealing with work done in related fields. Average 1956 prices were used to calculate costs: Fuel costs were computed to show their increase as the farms become more and more distant from Winnipeg. Management and overhead costs that apply equally to all crops are not discussed in this bulletin. Estimates are made of the amount of labor required but labor costs are not included.

Costs of Machine Operation

The costs of owning and operating farm machinery are made up of the price of the machine, interest on capital, repairs, fuel, oil and grease costs. In spite of advances in perfecting farm machinery, it remains among the most costly items in crop production.

Fuel, oil and grease costs.— These costs are directly related to the amount of work done, rate of fuel consumption by the machine, and the price of fuel, oil and grease. Freight charges result in an increase in the cost of these items as the distance from a central marketing point becomes greater. In Manitoba this central point is Winnipeg.

Repair costs.— Repair costs for most tillage machines vary slightly between districts. Broken parts are generally more common in stony areas. Repair costs shown in this study include a charge for welding, parts purchased, and hired repair labor.

Depreciation.— Depreciation is the decrease in the value of a machine as a result of wear or obsolescence, or both. It is calculated in order to set aside an investment which can replace the machine after a certain number of years. In this study five per cent of the replacement costs is considered a trade-in or scrap value and depreciation itself is calculated on 95 per cent of the replacement value.

The expected lifetime use of each machine was calculated in both years and hours, to indicate the average number of years a machine is used on Manitoba farms and the average number of hours of labor a machine is likely to supply in its lifetime.

Interest on capital invested.— Capital invested in machinery could, theoretically, be invested in non-farm assets where it would earn money. Therefore, an interest charge is made for the use of capital at the rate of five per cent on one-half of the replacement cost of the machine.

Investment in machinery.— Some farmers attempt to cut the costs of owning machinery by having custom work done or by owning machinery in partnership. Combines and swathers are the machines most often owned in partnership. In a survey in south-central Manitoba in 1955 about 85 per cent of the farmers owned combines and 25 per cent of these combines were owned in partnership. About 87 per cent of the farmers owned swathers of which about 19 per cent were owned in partnership. A survey in the Waskada Soils Area in the same year showed that about 89 per cent of the farmers owned combines and 15 per cent of these were owned in partnership. About 87 per cent of the farmers owned swathers, 12 per cent being owned in partnership. In 1955 about ten per cent of the crop acreage in these areas was swathed and combined by custom operators.

The machines included in the tables in this bulletin are the ones most commonly found on farms with from 300 to 450 acres of cropland. Smaller machines are being used on some farms but when these machines are replaced they are almost always replaced by larger ones. The costs of operation for some of these smaller machines are included in Tables in the Appendix.

Appendix 4 shows the investment in farm machinery on a typical farm in each of the six areas. The size of machine used varied between districts as indicated throughout the tables.

Tillage Operations

The tillage practices used in crop production vary from crop to crop, area to area, and year to year. Weather conditions influence the practices followed in any particular year. Some of the tables in this bulletin show the most frequent cultural practices in the production of field crops, the time required, and the machinery costs of performing these operations.

Materials Used in Crop Production

The amount of seed, fertilizer, and weed spray used in crop production varies from district to district, year to year, and crop to crop. A few farmers in each district use commercial fertilizer on some of their crops but its use is not widespread. Weed spraying is a common practice in all districts. Because of this, weed spraying has been included in the operations shown although it may be lacking in any one particular year because of adverse weather conditions.

Labor Requirements

In addition to the time spent in actual operation of machinery, labor must be expended in such tasks as daily servicing and caring for machines, making adjustments and minor repairs, hauling seed, and hauling grain. The average time required on these operations is shown in the Appendices.

RED RIVER VALLEY AREA

The soils of the Red River Valley of Manitoba are fertile black earth soils of fine texture and good depth and free of stones. Because of the very flat topography flooding and drainage are recurrent problems. Considering 29.5°F. as the critical temperature for frost injury to crops, the frost-free period ranges from 130 to 140 days. Precipitation averages about 20 inches per year with about 9.5 inches falling in the months from April to July and 6.0 inches from August to October.

Grain farms predominate but there are some dairy farms close to Winnipeg. Crops such as corn, sunflowers, sugar beets, and alfalfa, are grown on fairly small acreage.

The half section farm is the most common size. About 94 per cent of the land is improved. Wheat occupies about 27 per cent of the cultivated land, oats 17 per cent, barley 24 per cent and summerfallow 22 per cent. The remainder is in such crops as flax, forage and special crops. The common seeding rates per acre are 1.5 bushels for wheat, 2.5 bushels for oats, 1.5 bushels for barley and 35 pounds for flax. The long-time annual average yield is about 20 bushels per acre for wheat, 32 bushels for oats and 24 bushels for barley. The most common crop rotation is a four-year rotation of summerfallow, wheat, and two years of coarse grains. The second most common rotation is a three-year rotation of summerfallow, wheat, coarse grains.

Almost all farmers use chemical weed killers on wheat, oats, barley and flax. Recent studies show that about 15 per cent of the farmers use fertilizer on some of their crops. Although it is not a recommended practice some farmers burn the straw and stubble after combining a heavy crop. Most of the land is fall-tilled at least once.

The following tables show the most common tillage and harvesting operations for the common crops, the time required, and the machinery costs in the area. On the fine-textured soils the draft of tillage machinery is heavier than in most other areas of the province. On the one-half and three-quarter section farms the 3-4 plow tractor is the most common size, about 60 per cent of the farms having a two plow or 2-3 plow size as a second tractor. The smaller tractor is used for swathing and spraying.

The tillage practices and sequences 1/ shown for this area are

1/ "Sequence" in this report refers to the set and order of machine operations used in a particular part of the crop production operations, i.e. in pre-seeding operations, in summerfallowing, in harvesting, etc.

based on data from a survey made in 1952. The two most common sequences of tillage operations on summerfallow are shown in Table 1.

Table 1.- Time required and costs of machinery for summerfallow operations, Red River Valley, Manitoba

Operation	: Acres :		: Hours :	Cost per acre		
	: per :	: Times :	: per :			
	: hour :	: over :	: acre :	: Machine :	: Tractor :	: Total
- dollars -						
- Sequence A -						
Plow (3-14 in.)	1.2	1	0.83	0.40	1.02	1.42
Disk (12 ft.)	4.5	1	0.22	0.16	0.25	0.41
Cultivator (12 ft.)	4.0	3	0.75	0.39	0.84	1.23
Drag harrow (36 ft.)	10.0	2	<u>0.20</u>	0.06	0.24	<u>0.30</u>
Total			2.00			3.36
- Sequence B -						
Oneway (8 ft.)	3.0	2	0.66	0.42	0.82	1.24
Cultivator (12 ft.)	4.0	3	0.75	0.39	0.84	1.23
Drag harrow (36 ft.)	10.0	2	<u>0.20</u>	0.06	0.24	<u>0.30</u>
Total			1.61			2.77

When wheat, oats or barley are grown on summerfallow the same general tillage practices are used. The typical operations are shown in Table 2.

Table 2.- Time required and costs of machinery for pre-harvest operations, wheat, oats, barley on summerfallow, Red River Valley, Manitoba

Operation	: Acres :		: Hours :	Cost per acre		
	: per :	: Times :	: per :			
	: hour :	: over :	: acre :	: Machine :	: Tractor :	: Total
- dollars -						
<u>Pre-seeding:</u>						
Cultivator (12 ft.)	4.0	2	0.50	0.26	0.56	0.82
Drag harrow (36 ft.)	10.0	1	0.10	0.03	0.12	0.15
<u>Seeding and post-seeding:</u>						
Drill (14 ft.)	4.5	1	0.22	0.24	0.27	0.51
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30
Spray (30 ft.)	9.0	1	<u>0.11</u>	0.08	0.10	<u>0.18</u>
Total			1.13			1.96

There are two sequences of tillage operations commonly used when wheat is grown on land that was in crop the previous year. These are shown in Table 3.

Table 3.- Time required and costs of machinery for pre-harvest operations, wheat on stubble, Red River Valley, Manitoba

	: Acres:		: Hours:			
	: per	: Times:	: per	Cost per acre		
Operation	: hour	: over	: acre	Machine:	Tractor:	Total
				- dollars -		
- Sequence A -						
<u>Pre-seeding:</u>						
Plow (3-14 in.)	1.2	1	0.83	0.40	1.02	1.42
Disk (12 ft.)	4.5	2	0.44	0.32	0.50	0.82
Drag harrow (36 ft.)	10.0	1	0.10	0.03	0.12	0.15
<u>Seeding and post-seeding:</u>						
Drill (14 ft.)	4.5	1	0.22	0.24	0.27	0.51
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30
Spray (30 ft.)	9.0	1	<u>0.11</u>	0.08	0.10	<u>0.18</u>
Total			1.90			3.38
- Sequence B -						
<u>Pre-seeding:</u>						
Disk (12 ft.)	4.5	1	0.22	0.16	0.25	0.41
Cultivator (12 ft.)	4.0	2	0.50	0.26	0.56	0.82
Drag harrow (36 ft.)	10.0	1	0.10	0.03	0.12	0.15
<u>Seeding and post-seeding:</u>						
Drill (14 ft.)	4.5	1	0.22	0.24	0.27	0.51
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30
Spray (30 ft.)	9.0	1	<u>0.11</u>	0.08	0.10	<u>0.18</u>
Total			1.35			2.37

Table 4.- Time required and costs of machinery for pre-harvest operations, oats and barley on stubble, Red River Valley, Manitoba

	: Acres:		: Hours:			
	: per	: Times:	per	: Cost per acre		
Operation	: hour	: over	: acre	: Machine:	Tractor:	Total
					- dollars -	
- Sequence A -						
Pre-seeding:						
Plow (3-14 in.)	1.2	1	0.83	0.40	1.02	1.42
Disk (12 ft.)	4.5	2	0.44	0.32	0.50	0.82
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30
Seeding and post-seeding:						
Drill (14 ft.)	4.5	1	0.22	0.24	0.27	0.51
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30
Spray (30 ft.)	9.0	1	0.11	0.08	0.10	0.18
Total			2.00			3.53
- Sequence B -						
Pre-seeding:						
Disk (12 ft.)	4.5	1	0.22	0.16	0.25	0.41
Cultivator (12 ft.)	4.0	2	0.50	0.26	0.56	0.82
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30
Seeding and post-seeding:						
Drill (14 ft.)	4.5	1	0.22	0.24	0.27	0.51
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30
Spray (30 ft.)	9.0	1	0.11	0.08	0.10	0.18
Total			1.45			2.52

When oats and barley are seeded on land that was in crop the previous year seeding is often delayed to allow for extra tillage to control weeds. The time required in their production is greater than for wheat.

Flax is most commonly grown on land that was in crop the previous year. The relatively clean seedbed required for this crop is made possible by extra pre-seeding cultivation. Two typical sequences of tillage operations used in preparing a seedbed for flax are shown in Table 5.

Table 5.- Time required and costs of machinery for pre-harvest operations, flax on stubble, Red River Valley, Manitoba

	: Acres	:	: Hours	:			
	: per	: Times	: per	:	Cost per acre		
Operation	: hour	: over	: acre	:	Machine	Tractor	Total
- dollars -							
- Sequence A -							
Pre-seeding:							
Plow (3-14 in.)	1.2	1	0.83	0.40	1.02		1.42
Disk (12 ft.)	4.5	1	0.22	0.16	0.25		0.41
Cultivator (12 ft.)	4.0	2	0.50	0.26	0.56		0.82
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24		0.30
Seeding and post-seeding:							
Drill (14 ft.)	4.5	1	0.22	0.24	0.27		0.51
Drag harrow (36 ft.)	10.0	1	0.10	0.03	0.12		0.15
Spray (30 ft.)	9.0	1	0.11	0.08	0.10		0.18
Total			2.18				3.79
- Sequence B -							
Pre-seeding:							
Disk (12 ft.)	4.5	2	0.44	0.32	0.50		0.82
Cultivator (12 ft.)	4.0	2	0.50	0.26	0.56		0.82
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24		0.30
Seeding and post-seeding:							
Drill (14 ft.)	4.5	1	0.22	0.24	0.27		0.51
Drag harrow (36 ft.)	10.0	1	0.10	0.03	0.12		0.15
Spray (30 ft.)	9.0	1	0.11	0.08	0.10		0.18
Total			1.57				2.78

Sunflowers are one of the special crops grown in this area in recent years. Two typical sequences of tillage operations used in their production are shown in Table 6. The 2-3 plow tractor is used for after-seeding cultivation.

Table 6.- Time required and costs of machinery for pre-harvest operations, sunflowers on stubble, Red River Valley, Manitoba

Operation	: Acres :		: Hours :		Cost per acre		
	: per	: Times	: per	:			
	: hour	: over	: acre	:	Machine	Tractor	Total
- dollars -							
- Sequence A -							
<u>Pre-seeding:</u>							
Flow (3-14 in.)	1.2	1	0.83	0.40	1.02	1.42	
Disk (12 ft.)	4.5	1	0.22	0.16	0.25	0.41	
Drag harrow (36 ft.)	10.0	3	0.30	0.09	0.36	0.45	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	3.9	1	0.26	0.24	0.27	0.51	
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30	
Cultivator (2 row)	2.3	3	<u>1.29</u>	0.16	0.39	<u>0.55</u>	
Total			3.10			3.64	
- Sequence B -							
<u>Pre-seeding:</u>							
Cultivator (12 ft.)	4.0	2	0.50	0.26	0.56	0.82	
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	3.9	1	0.26	0.24	0.27	0.51	
Drag harrow (36 ft.)	10.0	2	0.20	0.06	0.24	0.30	
Cultivator (2 row)	2.3	3	<u>1.29</u>	0.16	0.39	<u>0.55</u>	
Total			2.45			2.48	

The swather and combine is the harvesting method most frequently used on farms in this area. The 12-foot self-propelled combine and the 12-foot auxiliary motor pull-type are both common. The comparative costs of combining grains with these combines are illustrated in Table 7. There is very little difference in the per-acre costs of harvesting wheat, oats, barley and flax.

Table 7.- Time required and costs of machinery for harvesting operations, Wheat, oats, barley, flax on summerfallow or stubble, Red River Valley, Manitoba

Operation	: Acres :		: Hours :		Cost per acre		
	: per	: Times	: per	:			
	: hour	: over	: acre	:	Machine	Tractor	Total
- dollars -							
- Sequence A -							
Swather (12 ft.)	4.8	1	.21	0.21	0.19	0.40	
Combine (12 ft. S.P.)	3.0	1	<u>.33</u>	2.32	-	<u>2.32</u>	
Total			.54				2.72
- Sequence B -							
Swather (12 ft.)	4.8	1	.21	0.21	0.19	0.40	
Combine (12 ft. A.M.)	2.8	1	<u>.35</u>	1.61	0.44	<u>2.05</u>	
Total			.56				2.45

The ordinary combine is modified for sunflower harvesting by the addition of simple and fairly low cost attachments. The attachments are a solid reel, that is, one with the space between the reel slats filled in, and pans protruding in front of the cutting bar. The pans fill the space between the rows and straighten up the stalks, making cutting easier. Table 8 summarizes the data on costs of combining sunflowers.

Table 8.- Time required and costs of machinery for harvesting operations, Sunflowers, Red River Valley, Manitoba

Operation	: Acres :		: Hours :	Cost per acre		
	: per	: Times	: per			
	: hour	: over	: acre	: Machine	: Tractor	: Total
				- dollars -		
Combine (12 ft. S.P.)	3.2	1	0.31	2.18	-	2.18
Combine (12 ft. A.M.)	3.0	1	0.33	1.50	0.41	1.91

SOUTH CENTRAL MANITOBA

In the area of South Central Manitoba for which information on tillage operations and sequences is available, the soils are Black Earth and Grey Wooded and predominantly clay loam in texture. Topography varies from moderately undulating to very hilly. Water erosion, soil drifting and stones are local problems. Considering 29.5°F. as the critical temperature for frost injury to crops, the frost-free period ranges from 130 to 135 days. Precipitation averages about 18.4 inches a year with, about nine inches falling in the months of April to July and 5.3 inches from August to October.

Grain farms predominate, but many farmers have one or more livestock enterprises. Crops such as rye, buckwheat, rape and forage are grown on a small acreage.

The half-section farm is the most common size, although the average size of farm is about 420 acres. About 75 per cent of the land is improved. In 1954 and 1955 wheat occupied about 22 per cent of the cropland, oats 11 per cent, barley 27 per cent, flax four per cent and summerfallow 30 per cent. The remainder was in such crops as rye, buckwheat and forage. The average seeding rates per acre were as follows: wheat 1.3 bushels, oats 2.0 bushels, barley 1.6 bushels and flax 33 pounds. The long-time average yields are about 21 bushels per acre for wheat, 33 bushels for oats and 25 bushels per acre for barley. The most common crop rotation is a three-year rotation of summerfallow-grain-grain. About 95 per cent of the wheat was grown on summerfallow, about eight per cent of the oats, about 23 per cent of the barley and six per cent of the flax. The remainder of these crops was grown on stubble land.

Almost all farmers use chemical weed killers on wheat, oats, barley,

and flax. About one-quarter of the farmers use commercial fertilizer on some of their crops. Most of the land is fall-tilled at least once.

The following tables show the most common tillage and harvesting operations, the time required, and costs for these operations for wheat, oats, barley, flax and summerfallow. About one-half of the farms have two tractors. The most popular tractor is the 3-4 plow size with a two-plow or 2-3 plow tractor as the second one on two-tractor farms. The 3-4 plow tractor is used for all operations except swathing and spraying.

The tillage practices and sequences shown are based on a survey made in 1955. Two sequences of tillage operations on summerfallow are shown in Table 9.

Table 9.- Time required and costs of machinery for summerfallow operations, South Central Manitoba

Operation	: Acres :	: Hours:		Cost per acre		
	: per	: Times	: per			
	: hour	: over	: acre	Machine	Tractor	Total
- dollars -						
- Sequence A -						
Plow (3-14 in.)	1.2	1	.83	0.48	1.05	1.53
Cultivator (10 ft.)	3.1	3	.96	0.45	1.22	1.67
Drag harrow (30 ft.)	8.0	2	.24	0.07	.30	.37
Total			2.03			3.57
- Sequence B -						
One way (8 ft.)	2.6	2	.76	0.55	0.97	1.52
Cultivator (10 ft.)	3.1	3	.96	0.45	1.22	1.67
Harrow (30 ft.)	8.0	2	.24	0.07	0.30	0.37
Total			1.96			3.56

When wheat, oats, or barley are grown on summerfallow, the same tillage operations are generally followed. The typical operations are described in Table 10.

Table 10.- Time required and costs of machinery for pre-harvest operations, wheat, oats, and barley on summerfallow, South Central Manitoba

Operation	: Acres :	: Hours:		Cost per acre		
	: per	: Times	: per			
	: hour	: over	: acre	Machine	Tractor	Total
- dollars -						
<u>Pre-seeding:</u>						
Cultivator (10 ft.)	3.1	2	0.64	0.30	0.81	1.11
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	4.1	1	0.24	0.24	0.30	0.54
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18
Spray (30 ft.)	8.0	1	0.12	0.08	0.11	0.19
Total pre-harvest			1.24			2.20

Generally, when oats or barley are grown on stubble the same tillage practices are used. These typical operations are listed in Table 11.

Table 11.- Time required and costs of machinery for pre-harvest, operations, oats and barley on stubble, South Central Manitoba

	: Acres :		: Hours :			
	: per	: Times	: per	: Cost per acre		
Operation	: hour	: over	: acre	: Machine:	: Tractor:	: Total:
	- dollars -					
<u>Pre-seeding:</u>						
Plow (3-14 in.)	1.2	1	0.83	0.48	1.05	1.53
Cultivator (10 ft.)	3.1	2	0.64	0.30	0.81	1.11
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	4.1	1	0.24	0.24	0.30	0.54
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>
Total pre-harvest			2.07			3.73

There are two sequences of tillage operations commonly used when flax is grown on land that was in crop the previous year. These are described in Table 12.

Table 12.- Time required and costs of machinery for pre-harvest, operations, flax on stubble, South Central Manitoba

	: Acres :		: Hours :			
	: per	: Times	: per	: Cost per acre		
Operation	: hour	: over	: acre	: Machine:	: Tractor:	: Total
- Sequence A -				- dollars -		
<u>Pre-seeding:</u>						
Plow (3-14 in.)	1.2	1	0.83	0.48	1.05	1.53
Cultivator (10 ft.)	3.1	2	0.64	0.30	0.81	1.11
Drag harrow (30 ft.)	8.0	3	0.36	0.10	0.46	0.56
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	4.2	1	0.24	0.24	0.30	0.54
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>
Total pre-harvest			2.31			4.11
- Sequence B -						
<u>Pre-seeding:</u>						
Oneway (8 ft.)	2.6	1	0.38	0.27	0.48	0.75
Cultivator (10 ft.)	3.1	2	0.64	0.30	0.81	1.11
Drag harrow (30 ft.)	8.0	3	0.36	0.10	0.46	0.56
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	4.1	1	0.24	0.24	0.30	0.54
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>
Total pre-harvest			1.86			3.33

The swather and combine method is the harvesting method most frequently used in this area. The 12-foot self-propelled combine and the 12-foot auxiliary motor pull-type are both common. The costs of combining grain with these machines are shown in Table 13. There is very little difference in per-acre costs of harvesting the various grains, therefore the same costs are shown for wheat, oats, barley and flax.

Table 13.- Time required and costs of machinery for harvest operations, wheat, oats, barley and flax, South Central Manitoba

Operation	: Acres :		: Hours :	Cost per acre		
	: per : hour	: Times : over	: per : acre	: Machine:	: Tractor :	: Total
- dollars -						
- Sequence A -						
Swather (12 ft.)	4.5	1	0.22	0.22	0.20	0.42
Combine (12 ft. A.M.)	2.6	1	<u>0.38</u>	1.73	0.48	<u>2.21</u>
Total harvest			0.60			2.63
- Sequence B -						
Swather (12 ft.)	4.5	1	0.22	0.22	0.20	0.42
Combine (12 ft. S.P.)	2.8	1	<u>0.35</u>	2.46	-	<u>2.46</u>
Total harvest			0.57			2.88

WEST CENTRAL MANITOBA

Clay loam soils of the Newdale Association cover a large area in West Central Manitoba. They are Northern Black Earth soils developed on glacial till. Topography is undulating to gently rolling. Erosion on knolls, impeded drainage and stony areas are local problems. Considering 29.5°F. as the critical temperature for frost injury to crops, the frost-free period ranges from 110 to 115 days. The average annual precipitation is between 16 and 17 inches, about 8.5 inches falling during the growing season, April to July, and 4.5 inches during August to October.

Grain farms predominate but many farmers have one or more livestock enterprises. For many years this zone was known as the oats country. Excellent crops of oats with heavy weight per bushel were grown. Wheat, oats and barley are the main crops, with flax, rye and forage being grown on a small acreage.

The half-section farm is the most common size although the average acreage per farm is about 440 acres. About two-thirds of the land is improved. A study made in this area in 1956 showed that wheat occupied about 18 per cent of the cropland, oats about 16 per cent, barley about 23 per cent, flax about three per cent and summerfallow about 35 per cent.

The remainder is taken up by mixed grains, rye and forage crops. The most common seeding rates per acre are as follows: wheat 1.5 bushels, oats 2.5 and 3.0 bushels, barley 2.0 bushels and flax about 33 pounds. The long-time average yield is about 24 bushels per acre for wheat, 41 bushels for oats, and 28 bushels for barley. The most common rotation is a three-year rotation of summerfallow-grain-grain. Most of the land is fall tilled at least once.

Two-thirds of the farmers sprayed or dusted some of their crop in 1956. Another 25 per cent would have sprayed some of their crops but were unable to do so because of wet weather. About one-fifth of the farmers used commercial fertilizer on some of their crops.

Generally, the time required to perform tillage and harvesting operations takes somewhat longer than in the Red River Valley because of sloughs and patches of brush and wasteland, which makes the fields irregular and small in size.

The following tables show the most common tillage and harvest operations for the common crops, the time required, and the costs of these operations. The basic data on sequences and field operations were obtained in a survey made in 1956. About one-third of the farmers have two tractors. The most popular tractor is a 3-4 plow size with a 2-3 plow or a two-plow as the second tractor on two-tractor farms. The 3-4 plow tractor is used for all operations except swathing and spraying. Two sequences of tillage operations on summerfallow are shown in Table 14.

Table 14.- Time required and costs of machinery operations on summerfallow, West Central Manitoba

	: Acres :		: Hours:			
	: per	: Times	: per	: <u>Cost per acre</u>		
Operation	: hour	: over	: acre	: Machine:	Tractor :	Total
					- dollars -	
- Sequence A -						
Oneway (6 ft.)	2.1	2	0.96	0.64	1.22	1.86
Cultivator (10 ft.)	3.2	4	1.24	0.58	1.57	2.15
Drag harrow (30 ft.)	8.0	3	<u>0.36</u>	0.10	0.46	<u>0.56</u>
Total			2.56			4.57
- Sequence B -						
Disk (12 ft.)	4.1	2	0.48	0.36	0.61	0.97
Cultivator (10 ft.)	3.2	4	1.24	0.58	1.57	2.15
Drag harrow (30 ft.)	8.0	3	<u>0.36</u>	0.10	0.46	<u>0.56</u>
Total			2.08			3.68

In 1956 about 90 per cent of the wheat, 25 per cent of the oats and 50 per cent of the barley was grown on summerfallow. The typical operations for wheat grown on summerfallow are shown in Table 15.

Table 15.- Time required and costs of machinery for pre-harvest operations, wheat on summerfallow, West Central Manitoba

	: Acres :		: Hours:		Cost per acre		
	: per	: Times	: per	:			
Operation	: hour	: over	: acre	:	Machine:	Tractor:	Total
					- dollars -		
<u>Pre-seeding:</u>							
Cultivator (10 ft.)	3.2	1	0.31	0.15	0.39	0.54	
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18	
<u>Seeding and post-seeding:</u>							
Drill (12 ft.)	4.1	1	0.24	0.24	0.30	0.54	
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>	
Total pre-harvest			0.91				1.63

It is customary to use one extra tillage operation for oats and barley grown on summerfallow. Time can be taken to do this as they are usually planted later than wheat. The typical operations are shown in Table 16.

Table 16.- Time required and costs of machinery for pre-harvest operations, barley and oats on summerfallow, West Central Manitoba

	: Acres :		: Hours:				
	: per	: Times	: per	:	Cost per acre		
Operation	: hour	: over	: acre	:	Machine:	Tractor:	Total
					- dollars -		
<u>Pre-seeding:</u>							
Cultivator (10 ft.)	3.2	1	0.31		0.15	0.39	0.54
Drag harrow (30 ft.)	8.0	2	0.24		0.07	0.30	0.37
<u>Seeding and post-seeding:</u>							
Drill (12 ft.)	4.1	1	0.24		0.24	0.30	0.54
Drag harrow (30 ft.)	8.0	1	0.12		0.03	0.15	0.18
Spray (30 ft.)	8.0	1	<u>0.12</u>		0.08	0.11	<u>0.19</u>
Total pre-harvest			1.03				1.82

Similar tillage operations are used to produce oats and barley on stubble and are shown in Table 17.

Table 17.- Time required and costs of machinery for pre-harvest operations, oats and barley on stubble, West Central Manitoba

	: Acres :		: Hours :			
	: per	: Times	: per	: Cost per acre		
Operation	: hour	: over	: acre	: Machine	: Tractor	: Total

There is relatively little flax grown in this area and most of it is grown on stubble land. Extra harrowing is required to give a firm seedbed for this crop. The tillage operations and machinery costs are shown in Table 18 for flax on stubble.

Table 18.- Time required and costs of machinery for pre-harvest, operations, flax on stubble, West Central Manitoba

	: Acres:		: Hours:			
	: per	: Times:	per	:	Cost per acre	
Operation	: hour	: over	: acre	: Machine	: Tractor	: Total
						- dollars -
<u>Pre-seeding:</u>						
Oneway (6 ft.)	2.1	1	0.48	0.32	0.61	0.93
Cultivator (10 ft.)	3.2	2	0.62	0.29	0.79	1.08
Drag harrow (30 ft.)	8.0	3	0.36	0.10	0.46	0.56
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	4.1	1	0.24	0.24	0.30	0.54
Drag harrow (30 ft.)	8.0	1	0.12	0.03	0.15	0.18
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>
Total pre-harvest			1.94			3.48

The swather and combine method of harvesting is the most common harvesting method in this region. The 12-foot self-propelled and the six and 12-foot auxiliary motor pull-type combines are all common. A study in 1956 showed that about 15 per cent of the farmers used the binder and thresh method to harvest some of their crops, most of it being oats. There is very little difference in per acre costs of harvesting the various grains. The same costs are shown for wheat, oats, barley and flax in Table 19.

Table 19.- Time required and costs of machinery for harvesting operations, wheat, oats, barley and flax, West Central Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per		: Times:		per		
	: hour	: over	: acre	: Machine	: Tractor	: Total	
- Sequence A -							
Swather (12 ft.)	3.8	1	0.26	0.27	0.24	0.51	
Combine (6 ft. A.M.)	1.5	1	<u>0.67</u>	1.75	0.85	<u>2.60</u>	
Total harvest			0.93			3.11	
- Sequence B -							
Swather (12 ft.)	3.8	1	0.26	0.27	0.24	0.51	
Combine (12 ft. A.M.)	2.2	1	<u>0.45</u>	2.05	0.57	<u>2.62</u>	
Total harvest			0.71			3.13	
- Sequence C -							
Swather (12 ft.)	3.8	1	0.26	0.27	0.24	0.51	
Combine (12 ft. S.P.)	2.5	1	<u>0.40</u>	2.81	-	<u>2.81</u>	
Total harvest			0.66			3.32	

WASKADA SOILS AREA

The area covered by Waskada Soils is a rather smooth till plain around Waskada, Deloraine and Boissevain in southwestern Manitoba. These soils are Dark Brown Steppe-Black Earth Transition soils of predominantly loam texture. The most serious problem in the area is one of periodic climatic drought. Some small shallow pot-holes are found in the more level parts of the area and present a localized drainage problem. Considering 29.5°F as the critical temperature for frost injury to crops, the frost-free period ranges from 115 to 125 days. The annual precipitation fluctuates widely, and is about 18.0 inches per year with an average of 9.0 inches falling in the months of April to July and about 4.7 inches falling in August to October. The precipitation at Deloraine during the months of April to July has varied from a low of

1.32 inches in 1911 to a high of 22.11 inches in 1903.

This is a grain-growing area with wheat, oats, barley and flax as the chief crops. Some rye, millet and grasses are grown on a few farms. Some farmers have a supplementary beef cattle enterprise.

The farms of three and four quarter-sections account for the largest proportion of the acreage of Waskada soils. A study in the area in 1955 showed that about 84 per cent of the land was improved. Wheat occupied about 21 per cent of the cultivated land, oats eight per cent, barley 20 per cent, flax 13 per cent and summerfallow 33 per cent. Small acreages in such crops as rye, millet, and forage made up the remainder. The average seeding rates per acre were 1.4 bushels for wheat, 2.0 bushels for oats, 1.6 bushels for barley and 35 pounds for flax. The long-time annual average yield is about 15.8 bushels for wheat. No figures are available for long-time annual yields for the other grains. All grain yields fluctuate widely from year to year. The most common crop rotation is a three-year fallow-grain-grain rotation.

Almost all farmers use chemical weed killers on wheat, oats, barley and flax. In 1955 only one of every 13 farmers reported the use of commercial fertilizer. Fall tillage of land is a general practice in this area.

Over two-thirds of the farmers on four-quarter section farms had more than one tractor in 1955. The 3-4 plow tractor is used except for swathing and spraying when a 2-3 plow size is used. The tillage practices and sequences shown are based on a survey made in 1955.

Table 21.- Time required and costs of machinery for summerfallow operations, Waskada Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:	Machine:	Tractor	Total
	hour	over	acre	:			
- dollars -							
- Sequence A -							
Plow (4-14 in.)	1.5	1	0.66	0.46	0.84	1.30	
Disk (12 ft.)	4.1	1	0.24	0.18	0.30	0.48	
Cultivator (12 ft.)	3.6	3	<u>0.84</u>	0.44	1.07	<u>1.51</u>	
Total			1.74				3.29
- Sequence B -							
Oneway (8 ft.)	2.6	2	0.76	0.55	0.97	1.52	
Cultivator (12 ft.)	3.6	4	<u>1.12</u>	0.58	1.42	<u>2.00</u>	
Total			1.88				3.52

Similar machinery operations are used when growing wheat, oats or barley on summerfallow as shown in Table 22. Almost all of the wheat and about one-half of the barley is seeded on summerfallow.

Table 22.- Time required and costs of machinery for pre-harvest operations, wheat, oats, barley on summerfallow, Waskada Soils Area, Manitoba

Operation	: Acres:		: Hours:		: Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	:	Machine	Tractor	Total
- dollars -							
<u>Pre-seeding:</u>							
Cultivator (12 ft.)	3.6	1	0.28	0.15	0.36	0.51	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.12	<u>0.20</u>	
Total pre-harvest			0.87				1.65

When stubble land is to be cropped, the usual practice is either to plow or oneway in the fall. The plowed land is generally harrowed in the spring while the onewayed land is cultivated. The comparative costs of these sequences as used for growing oats are shown in Table 23.

Table 23.- Time required and costs of machinery for pre-harvest operations, oats on stubble, Waskada Soils Area, Manitoba

Operation	: Acres:		: Hours:		: Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	:	Machine	Tractor	Total
- dollars -							
- Sequence A -							
<u>Pre-seeding:</u>							
Plow (4-14 in.)	1.5	1	0.66	0.46	0.84	1.30	
Drag harrow (30 ft.)	8.0	2	0.24	0.07	0.30	0.37	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.12	<u>0.20</u>	
Total pre-harvest			1.37				2.62
- Sequence B -							
<u>Pre-seeding:</u>							
Oneway (8 ft.)	2.6	1	0.38	0.27	0.48	0.75	
Cultivator (12 ft.)	3.6	2	0.56	0.29	0.71	1.00	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.12	<u>0.20</u>	
Total pre-harvest			1.41				2.70

Barley is frequently seeded late in order to carry out extra tillage operations for weed control. Two of the sequences commonly used are shown in Table 24.

Table 24.- Time required and costs of machinery for pre-harvest operations, barley on stubble, Waskada Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:	Machine	Tractor	Total
	: hour	: over	: acre	:			
					- dollars -		

- Sequence A -

<u>Pre-seeding:</u>							
Plow (4-14 in.)	1.5	1	0.66	0.46	0.84	1.30	
Disk (12 ft.)	4.1	1	0.24	0.18	0.30	0.48	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	0.12	0.08	0.12	0.20	
Total pre-harvest			1.49			2.92	

- Sequence B -

<u>Pre-seeding:</u>							
Oneway (8 ft.)	2.6	1	0.38	0.27	0.48	0.75	
Cultivator (12 ft.)	3.6	2	0.56	0.29	0.71	1.00	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	0.12	0.08	0.12	0.20	
Total pre-harvest			1.53			2.89	

Land to be seeded to flax generally is ploughed or onewayed in the fall. The common tillage practices are shown in Table 25.

Table 25.- Time required and costs of machinery for pre-harvest operations, flax on stubble, Waskada Soils Area Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:	Machine:	Tractor:	Total
	: hour	: over	: acre	:			
- Sequence A -							
- dollars -							
<u>Pre-seeding:</u>							
Oneway (8 ft.)	2.6	2	0.76	0.55	0.97	1.52	
Cultivator (12 ft.)	3.6	1	0.28	0.15	0.36	0.51	
Drag harrow (30 ft.)	8.0	2	0.24	0.07	0.30	0.37	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Spray (30 ft.)	8.0	1	0.12	0.08	0.12	0.20	
Total pre-harvest			1.63			3.16	
- Sequence B -							
<u>Pre-seeding:</u>							
Plow (4-14 in.)	1.5	1	0.66	0.46	0.84	1.30	
Oneway (8 ft.)	2.6	1	0.38	0.27	0.48	0.75	
Drag harrow (30 ft.)	8.0	2	0.24	0.07	0.30	0.37	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	0.12	0.08	0.12	0.20	
Total pre-harvest			1.75			3.37	

The swather and combine method of harvesting is the most popular method and is used for all grains. Costs of harvesting with a swather and self-propelled combine and with a swather and pull-type combine are shown in Table 26.

Table 26.- Time required and costs of machinery for harvesting operations, wheat, oats, barley, flax, Waskada Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:	Machine:	Tractor:	Total
	: hour	: over	: acre	:			
- Sequence A -							
- dollars -							
Swather (12 ft.)	4.5	1	0.22	0.22	0.20	0.42	
Combine (21 ft. S.P.)	2.8	1	0.35	2.46	-	2.46	
Total harvest			0.57			2.88	
- Sequence B -							
Swather (12 ft.)	4.5	1	0.22	0.22	0.20	0.42	
Combine (12 ft. A.M.)	2.6	1	0.38	1.73	0.48	2.21	
Total harvest			0.60			2.63	

OXBOW SOILS AREA

The Oxbow soils of southwest Manitoba are Black Earth Soils of variable topography and loam to clay loam in texture. Common problems are periodic drought, soil erosion on the knolls, small areas of saline soils and occasional stony areas. The area is characterized by numerous pot-holes and sloughs. Considering 29.5° F. as the critical temperature for frost injury to crops, the frost-free period is about 115 to 120 days. Precipitation averages about 16.5 inches per year with about 7.5 inches falling in the months of April to July and 5.0 inches in August to October.

This is a general grain area with some livestock and crop combinations. The chief crops are wheat, oats, and barley with some flax in recent years. The half-section farm is the most common size but the three-quarter and four-quarter sizes are also common. About 65 per cent of the farm land is improved. In 1955, wheat occupied about 22 per cent of the cultivated land, oats 17 per cent, barley 17 per cent, flax five per cent, summer-fallow 34 per cent and forage about four per cent. The average seeding rates per acre were: 1.4 bushels for wheat, 2.0 bushels for oats, 1.6 bushels for barley and 35 pounds for flax. The long-time annual average yield is about 15.5 bushels per acre for wheat, 24.5 bushels for oats and 21.5 bushels for barley. The most common crop rotation is a three-year rotation of summerfallow-grain-grain, with wheat being the first choice as a summerfallow crop, but all crops are grown on fallow to a certain extent. Wild grasses provide most of the hay and pasture required. In 1954 about 20 per cent of the oats crop was harvested as oats sheaves for feed.

About one-half of the farmers used chemical weed killers on wheat, oats, barley and flax. Only one farmer in 30 reported the use of commercial fertilizer.

The numerous pot-holes on many farms in this area hinder machinery operation. The time required per acre for most cultural operations is greater than in other areas. The 3-4 plow is the most common size of tractor used. About one-third of the three-quarter-section farms have a two or 2-3 plow tractor, as a second tractor, which is used for such things as swathing and spraying. The tillage practices and sequences shown in the following tables are based on a survey made in 1955.

Table 27.- Time required and costs of machinery for summerfallow operations, Oxbow Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	per	hour	Times:	per			
					Machine:	Tractor:	Total
			over:	acre	- dollars -		
Oneway (6 ft.)	2.0	1	0.51	0.34	0.65	0.99	
Cultivator (10 ft.)	2.9	4	1.36	0.64	1.73	2.37	
Drag harrow (30 ft.)	7.5	2	<u>0.26</u>	0.08	0.33	<u>0.41</u>	
Total			2.13				3.77

Table 27 shows the time required and costs of machinery operation for working a summerfallow in this area.

The machinery operations for growing wheat or oats on summerfallow are similar. Almost all of the wheat but only about 15 per cent of the barley and ten per cent of the oats is seeded on summerfallow. Barley is seeded later than oats and wheat and slightly more tillage is carried out.

Table 28.- Time required and costs of machinery for pre-harvest operations, wheat and oats on summerfallow, Oxbow Soils Area, Manitoba

	: Acres:		: Hours:			
	: per	: Times:	: per	Cost per acre		
Operation	: hour	: over	: acre	Machine:	Tractor:	Total
				- dollars -		
<u>Pre-seeding:</u>						
Cultivator (10 ft.)	2.9	1	0.34	0.16	0.43	0.59
Drag harrow (30 ft.)	7.5	1	0.13	0.04	0.17	0.21
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	3.2	1	0.31	0.31	0.39	0.70
Drag harrow (30 ft.)	7.5	1	0.13	0.04	0.17	0.21
Spray (30 ft.)	7.0	1	<u>0.14</u>	0.10	0.13	<u>0.23</u>
Total pre-harvest			1.05			1.94

Table 29.- Time required and costs of machinery for pre-harvest operations, barley on summerfallow, Oxbow Soils Area, Manitoba

	: Acres:		: Hours:			
	: per	: Times:	per	:	Cost per acre	
Operation	: hour	: over	: acre	: Machine:	Tractor:	Total
						- dollars -
<u>Pre-seeding:</u>						
Cultivator (10 ft.)	2.9	1	0.34	0.16	0.43	0.59
Drag harrow (30 ft.)	7.5	2	0.26	0.08	0.33	0.41
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	3.2	1	0.31	0.31	0.39	0.70
Drag harrow (30 ft.)	7.5	1	0.13	0.04	0.17	0.21
Spray (30 ft.)	7.0	1	<u>0.14</u>	0.10	0.13	<u>0.23</u>
Total pre-harvest			1.18			2.14

When oats or barley is seeded on stubble land the general practice is to use the oneway for a fall tillage operation followed by the cultivator in the spring. Very little wheat is grown as a second crop after summer-fallow.

Table 30.- Time required and costs of machinery for pre-harvest operations, barley and oats on stubble, Oxbow Soils Area, Manitoba

	: Acres:		: Hours:			
	: per	: Times:	: per	Cost per acre		
Operation	: hour	: over	: acre	: Machine:	: Tractor:	: Total
	- dollars -					
<u>Pre-seeding:</u>						
Oneway (6 ft.)	2.0	1	0.51	0.34	0.65	0.99
Cultivator (10 ft.)	2.9	2	0.68	0.32	0.86	1.18
Drag harrow (30 ft.)	7.5	1	0.13	0.04	0.17	0.21
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	3.2	1	0.31	0.31	0.39	0.70
Drag harrow (30 ft.)	7.5	1	0.13	0.04	0.17	0.21
Spray (30 ft.)	7.0	1	<u>0.14</u>	0.10	0.13	<u>0.23</u>
Total pre-harvest			1.90			3.52

Flax is generally seeded on stubble land. Extra tillage is used to obtain the good seed bed necessary for this crop.

Table 31.- Time required and costs of machinery for pre-harvest operations, flax on stubble, Oxbow Soils Area, Manitoba

	: Acres:		: Hours:			
	: per	: Times:	: per	:	Cost per acre	
Operation	: hour	: over	: acre	: Machine:	Tractor:	Total
						- dollars -
<u>Pre-seeding:</u>						
Oneway (6 ft.)	2.0	1	0.51	0.34	0.65	0.99
Cultivator (10 ft.)	2.9	2	0.68	0.32	0.86	1.18
Drag harrow (30 ft.)	7.5	2	0.26	0.08	0.33	0.41
<u>Seeding and post-seeding:</u>						
Drill (12 ft.)	3.2	1	0.31	0.31	0.39	0.70
Drag harrow (30 ft.)	7.5	1	0.13	0.04	0.17	0.21
Spray (30 ft.)	7.0	1	<u>0.14</u>	0.10	0.13	<u>0.23</u>
Total pre-harvest			2.03			3.72

The swather and combine method of harvesting grain crops is common although some oats and barley are cut with the binder and threshed with the threshing machine. The costs of swathing and combining are shown in Table 32.

The common practice when harvesting flax is to combine without swathing.

Table 32.- Time required and costs of machinery for harvesting operations, wheat, oats, barley, Oxbow Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	:	Machine	Tractor	Total
- dollars -							
- Sequence A -							
Swather (12 ft.)	3.5	1	0.28		0.29	0.26	0.55
Combine (12 ft. S.P.)	2.5	1	<u>0.40</u>		2.81	-	<u>2.81</u>
Total harvest			0.68				3.36
- Sequence B -							
Swather (12 ft.)	3.5	1	0.28		0.29	0.26	0.55
Combine (12 ft. A.M.)	2.2	1	<u>0.45</u>		2.05	0.57	<u>2.62</u>
Total harvest			0.73				3.17

Table 33.- Time required and costs of machinery for harvesting operations, flax, Oxbow Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	:	Machine	Tractor	Total
- dollars -							
Combine (12 ft. S.P.)	2.5	1	0.40		2.81	-	2.81
Combine (12 ft. A.M.)	2.2	1	0.45		2.05	0.57	2.62

SOURIS SOILS AREA

A level lacustrine plain that stretches from Lyleton in southwest Manitoba north to Virden and Kamnay is designated as the Souris Soils Area. They are coarse to medium textured soils with a single grain structure. They are very susceptible to drought and wind erosion. Considering 29.5°F. as the critical temperature for frost injury to crops, the frost-free period averages about 115 to 120 days. The annual precipitation fluctuates widely. It varied from a low of 10.29 inches in 1910 to a high of 28.98 inches in 1916. The annual average precipitation is about 17 inches per year with about 9.0 inches falling in the months of April to July and 5.0 inches in August to October.

Grain farms predominate with some farmers having a supplementary beef cattle enterprise. Wheat, oats, barley, flax and rye are the chief crops. In recent years flax has become a very important cash crop. Almost all farmers grow some forage.

The typical farm in this area has three or four quarter-sections with the average farm having just over 600 total acres. A study carried out in the area in 1956 showed that slightly more than 75 per cent of the land is improved. Wheat occupied about nine per cent of the cultivated land, oats 14 per cent, barley four per cent, flax 21 per cent, rye three per cent, summerfallow 26 per cent and forage 20 per cent. Flax acreage is probably higher than normal. The common seeding rates per acre are 1.5 bushels for wheat, 2.0 bushels for oats, 1.5 bushels for barley, 28 pounds for flax and 1.0 bushels for rye. The annual average yields per acre fluctuate widely. The long-time average annual yield is about 12 bushels per acre for wheat, 24 bushels for oats, 19 bushels for barley, 11 bushels for rye, and seven bushels for flax. The most common crop rotation is a three-year rotation of summerfallow-grain-grain. The crop following summerfallow is generally wheat or flax.

About one-half of the farmers make a general practice of using chemical weed killers on wheat, oats, barley and flax. In 1956 only one farmer out of 37 reported the regular use of commercial fertilizer.

Farmers in the area strive to maintain a trash cover on their fields to prevent soil erosion by wind action. Most farmers carry out one tillage operation on the land in the fall. The draft of most tillage machinery is lighter than in areas of finer soil texture. On the three-quarter-section farms a 3-4 plow tractor generally supplies the power. Over 60 per cent of the farmers on the four-quarter-section farms have more than one tractor, the 3-4 plow size being supplemented by a two or 2-3 plow size. The smaller tractor is used for such things as swathing and spraying.

The tillage practices and sequences shown are based on a survey made in 1956.

Table 34.- Time required and costs of machinery for summerfallow operations, Souris Soils Area, Manitoba

	: Acres:		: Hours:			
	: per	: Times:	: per	: Cost per acre		
Operation	: hour	: over	: acre	: Machine	: Tractor	: Total
					- dollars -	

Flax and wheat are the crops commonly seeded on summerfallow. The operations required for these crops are similar with the exception of some extra drag harrowing or packing of the seedbed for flax. These differences are shown in Tables 35 and 36.

Table 35.- Time required and costs of machinery for pre-harvest operations, wheat on summerfallow, Souris Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	:	Machine:	Tractor:	Total
- dollars -							
<u>Pre-seeding:</u>							
Cultivator (12 ft.)	3.6	1	0.28	0.15	0.36	0.51	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>	
Total pre-harvest			0.75				1.45

Table 36.- Time required and costs of machinery for pre-harvest operations, flax on summerfallow, Souris Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	:	Machine:	Tractor:	Total
- dollars -							
<u>Pre-seeding:</u>							
Cultivator (12 ft.)	3.6	1	0.28	0.15	0.36	0.51	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>	
Total pre-seeding			0.87				1.64

When growing oats and barley on stubble some farmers oneway in the fall and plow in the spring before seeding, and others oneway in the fall and again in the spring. The comparative costs of the two methods are shown in Table 27.

Table 37.4 Time required and costs of machinery for pre-harvest operations, oats and barley on stubble, Souris Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	: Machine	: Tractor	: Total	
- dollars -							
- Sequence A -							
<u>Pre-seeding:</u>							
Oneway (8 ft.)	2.6	1	0.38	0.27	0.48	0.75	
Plow (4-14 in.)	1.5	1	0.66	0.46	0.84	1.30	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>	
Total pre-harvest			1.63			3.18	
- Sequence B -							
<u>Pre-seeding:</u>							
Oneway (8 ft.)	2.6	2	0.76	0.55	0.97	1.52	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
<u>Seeding and post-seeding:</u>							
Drill (14 ft.)	4.4	1	0.23	0.27	0.29	0.56	
Drag harrow (30 ft.)	8.0	1	0.12	0.04	0.15	0.19	
Spray (30 ft.)	8.0	1	<u>0.12</u>	0.08	0.11	<u>0.19</u>	
Total pre-harvest			1.35			2.65	

The swather and combine method of harvesting is used for all grains. The costs of harvesting with two types of combine are shown in Table 38.

Table 38.- Time required and costs of machinery for harvesting operations, wheat, oats, barley and flax, Souris Soils Area, Manitoba

Operation	: Acres:		: Hours:		Cost per acre		
	: per	: Times:	: per	:			
	: hour	: over	: acre	: Machine	: Tractor	: Total	
- dollars -							
- Sequence A -							
Swather (12 ft.)	4.5	1	0.22	0.22	0.20	0.42	
Combine (12 ft. S.P.)	2.8	1	<u>0.35</u>	2.46	-	<u>2.46</u>	
Total harvest			0.57			2.88	
- Sequence B -							
Swather (12 ft.)	4.5	1	0.22	0.22	0.20	0.42	
Combine (12 ft. A.M.)	2.6	1	<u>0.38</u>	1.73	0.48	<u>2.21</u>	
Total harvest			0.60			2.63	

APPENDIX I - RATE OF PERFORMANCE

The speed of operation of farm machinery is influenced by topography, soil texture, and the incidence of such natural hazards as stones, sloughs and ravines. The following table shows the average time required to work one acre with some of the most common machines for six areas in Manitoba.

Number of hours required to work one acre, once over, by different machines showing variation between districts

	:	:	Area					
	:	:	Red	South-	West-	:	:	
Machine	Size	:	River	Central	Central	Oxbow	Waskada	Souris
			- hours -					
Plow	3-14 in.		0.83	0.83	0.83	1.04	0.83	0.83
	4-14 in.		0.62	0.66	0.66	1.00	0.66	0.66
Oneway	6 ft.		0.47	0.48	0.48	0.51	0.48	0.48
	8 ft.		0.33	0.38	0.38	0.42	0.38	0.38
Cultivator	10 ft.		0.28	0.32	0.31	0.34	0.32	0.32
	12 ft.		0.25	0.28	0.26	0.29	0.28	0.28
	14 ft.		0.22					
Drag harrow	30 ft.			0.12	0.12	0.13	0.12	0.12
	36 ft.		0.10					
Seed drill	10 ft.			0.26	0.26	0.37	0.26	0.26
	12 ft.		0.24	0.24	0.24	0.31	0.24	0.24
	14 ft.		0.22	0.23	0.23	0.26	0.23	0.23
Disk	12 ft.		0.22	0.24	0.24	0.25	0.24	0.24
Sprayer	30 ft.		0.11	0.12	0.12	0.14	0.12	0.12
Swather	12 ft.		0.21	0.22	0.26	0.28	0.22	0.22
Combine (A.M.)	6 ft.		0.67	0.67	0.67	0.67	0.67	0.67
Combine (A.M.)	12 ft.		0.35	0.38	0.45	0.45	0.38	0.38
Combine (S.P.)	12 ft.		0.33	0.35	0.40	0.40	0.35	0.35

APPENDIX II - MAN AND TRACTOR HOURS PER ACRE

In addition to the time spent in carrying out a particular field operation, time must be spent on such tasks as hauling seed, servicing and repairing machinery. In the following table tractor-hours represent the actual time that the individual machines were in operation; man-hours include such tasks as making minor repairs, servicing and caring for the machines, as well as time spent in operating the machines. The basic data for this table are from a study made in the Red River Valley in 1952.

Tractor-hours and Man-hours used in performing some
machinery operations^{a/}

Machine	Size of machine	Time per acre	
		Tractor-hours	Man-hours
Plow	3-14 in.	0.83	0.93
	4-14 in.	0.62	0.69
Oneway	6 ft.	0.47	0.53
	8 ft.	0.33	0.37
Cultivator	10 ft.	0.28	0.31
	12 ft.	0.25	0.28
Drag harrow	30 ft.	0.12	0.13
	36 ft.	0.10	0.11
Seed drill	12 ft.	0.24	0.30
	14 ft.	0.22	0.28
Disk	12 ft.	0.22	0.25
Sprayer	30 ft.	0.11	0.14
Swather	12 ft.	0.21	0.23
Combine (A.M.)	6 ft.	0.67	0.83
Combine (A.M.)	12 ft.	0.33	0.38
Combine (S.P.)	12 ft.	0.33	0.38

^{a/} For further information see MacKenzie, J.G. and J.C. Brown, How Labor is Used on Red River Valley Farms, Economics Division, Canada Department of Agriculture, December 1954.

APPENDIX III - LABOR REQUIRED TO HAUL GRAIN

The time and labor spent on hauling grain varies with the method of hauling and the length of haul. The grain may be hauled from the combine to the elevator or to storage bins at varying distances from the harvest field. The kinds and sizes of machines used in hauling are also quite variable. The following table shows the average time spent in hauling grain from combine to bin with a one-ton truck for a number of farms. The difference between truck-hours and man-hours is due to the extra time necessary to load and unload the grain and to service the truck.

Time required to haul grain from combine to bin with truck

Crop	Time per acre	
	Truck-hours	Man-hours
Wheat	0.24	0.36
Oats	0.26	0.40
Barley	0.30	0.44
Flax	0.26	0.36

APPENDIX IV - MACHINERY INVESTMENT

The amount of capital invested in machinery on farms in Manitoba reflects the degree of mechanization. The average investment in machinery varies between districts and with size of farm. The larger farms have a larger total investment in machinery although their investment per acre may be lower than on smaller farms. The following table shows the average investment in farm machinery on some Manitoba farms by district and by size of farm. The values shown are the depreciated values placed on the equipment by the owner.

Average machinery investment on some Manitoba farms

Area	: Year	: Size of farm		: Average investment in machinery		
	: of	: Total	: Cultivated	: Per	: Per total	: Per cultivated
	: study	: acres	: acres	: farm	: acre	: acre
- dollars -						
South-Central	1955	317	238	6,409	20.22	26.93
South-Central	1955	480	357	8,767	18.26	24.56
Waskada	1955	473	370	6,364	13.45	17.20
Waskada	1955	638	561	8,960	14.04	15.97
Oxbow	1955	322	224	4,224	13.12	18.86
Oxbow	1955	485	305	5,084	10.48	16.67
West-Central	1956	322	202	4,526	14.06	22.41
West-Central	1956	543	336	7,187	13.24	21.39
Souris	1956	597	462	5,820	9.75	12.60

APPENDIX V - MACHINERY AND EQUIPMENT INVENTORY

The number and kind of machinery on farms varies from district to district. The tractor is the most common machine in all districts. Many farms have more than one tractor. The cultivator is the tillage implement found most often in all districts. In some districts every farm has a moldboard plow while in others less than one-half have a plow. The average numbers and kinds of tillage and harvesting machinery on farms are summarized in the following table for a number of districts in Manitoba. In addition to the machines listed here most farms have additional investment in such things as fuel tank, trailers and grain loaders.

Average machinery and equipment inventory per farm

Area	: Red : River	: South- : Central	: West - : Central	: : Waskada	: : Oxbow	: : Souris
Year of survey	: 1957	: 1955	: 1956	: 1955	: 1955	: 1956
- number per farm -						
<u>Special equipment</u>						
Tractor	1.78	1.60	1.50	1.67	1.31	1.41
Combine	0.88	0.96	0.90	0.93	0.50	0.62
Swather	0.86	0.88	0.80	0.93	0.31	0.54
Baler	-	0.32	0.15	0.70	-	0.16
Car	0.84	0.80	0.85	0.87	0.81	0.73
Truck	0.95	0.64	0.75	0.53	0.20	0.65
<u>General equipment</u>						
Plow	1.10	1.04	0.40	1.01	0.81	1.03
Oneway	0.50	0.75	1.05	0.60	0.88	0.89
Drill	0.90	0.96	0.95	0.93	0.88	1.08
Cultivator	1.03	1.04	1.20	0.93	1.06	1.02
Disk harrow	0.29	0.40	0.30	0.27	0.19	0.08
Spring-tooth harrow	0.10	0.29	0.15	0.33	0.12	-
Drag harrow	0.97	1.00	1.05	1.00	0.94	1.00
Packer	0.05	0.17	0.20	0.33	0.06	0.49
Weed sprayer	0.62	0.50	0.55	0.47	0.38	0.32
Binder	0.07	0.54	0.50	0.33	0.88	0.49
Mower	0.71	1.00	0.90	0.60	0.94	0.95
Rake	0.52	1.04	0.95	0.47	1.00	0.94

APPENDIX VI - COSTS OF OPERATING FARM MACHINES

The following tables summarize the costs of owning and operating farm machinery on Manitoba farms. They are shown here to serve as guides to those who may desire to do some budgeting of their farm business operations. The costs are expressed as a cost per hour of operation based on an average annual amount of use and an average length of life. The same replacement value has been used for machines in both tables. The difference in operating costs reflects the difference between the Red River Valley and other parts of the province due to differences in costs of repairs, fuel, oil and grease.

Costs of operating farm machines per hour, Red River Valley, Manitoba, 1956 price level

Machine	Size	: Replace-: : ment : value :	: Lifetime expectancy: : Hours :	: Years :	Costs per hour of use					Total
					: Deprec-: : ation :	: Interest: :	: Repairs: :	: Fuel, oil: : grease :		
									- dollars -	
Tractor (gasoline)	4-5 pl.	4,050	10,000	15	0.38	0.15	0.11	0.90	1.54	
Tractor (gasoline)	3-4 pl.	3,325	10,000	15	0.32	0.12	0.11	0.67	1.22	
Tractor (gasoline)	2-3 pl.	2,600	10,000	15	0.25	0.10	0.08	0.46	0.89	
Tractor (gasoline)	2 pl.	2,150	9,000	15	0.23	0.09	0.08	0.39	0.79	
Combine (S.P.)	12 ft.	6,500	1,500	13	4.12	1.41	0.65	0.78	6.96	
Combine (A.M.)	12 ft.	4,000	1,500	13	2.53	0.87	0.52	0.59	4.51	
Combine (A.M.)	6 ft.	2,150	1,500	13	1.36	0.47	0.35	0.40	2.58	
Swather (P.T.)	12 ft.	825	1,300	13	0.60	0.21	0.20	0.01	1.02	
Plow	4-14 in.	550	2,500	25	0.20	0.14	0.25	0.01	0.60	
Plow	3-14 in.	425	2,500	25	0.16	0.11	0.20	0.01	0.48	
Disk	12 ft.	825	2,000	20	0.39	0.21	0.10	0.01	0.71	
Cultivator	12 ft.	425	2,000	20	0.20	0.11	0.20	0.01	0.52	
Cultivator	10 ft.	350	2,000	20	0.17	0.09	0.20	0.01	0.47	
Drag harrow	36 ft.	325	2,500	25	0.12	0.08	0.05	-	0.25	
Drill	14 ft.	850	1,500	20	0.54	0.28	0.27	0.01	1.10	
Drill	12 ft.	700	1,500	20	0.44	0.23	0.27	0.01	0.95	
Oneway	8 ft.	700	2,000	20	0.33	0.18	0.10	0.01	0.62	
Oneway	6 ft.	625	2,000	20	0.30	0.16	0.10	0.01	0.57	
Disk, single	21 ft.	500	2,000	20	0.24	0.12	0.05	0.01	0.42	
Disk, double	10 ft.	375	2,000	20	0.18	0.09	0.05	0.01	0.33	
Weed sprayer	30 ft.	275	1,000	20	0.26	0.14	0.30	-	0.70	
Rod cultivator	2 row	325	2,000	15	0.15	0.06	0.15	-	0.36	

Costs of operating farm machines per hour. South-central Manitoba, West-central Manitoba, Southwest Manitoba,
1956 price level

Machine	Size	Replacement value	Hours	Lifetime expectancy, Years	Costs per hour of use			
					Depreciation	Interest	Repairs	Fuel, oil, grease: Total cost
								- dollars -
Tractor (gasoline)	4-5 pl.	4,050	10,000	15	0.38	0.15	0.11	0.96
Tractor (gasoline)	3-4 pl.	3,325	10,000	15	0.32	0.12	0.11	0.72
Tractor (gasoline)	2-3 pl.	2,600	10,000	15	0.25	0.10	0.08	0.49
Tractor (gasoline)	2 pl.	2,150	9,000	15	0.23	0.09	0.08	0.42
Combine (S.P.)	12 ft.	6,500	1,500	13	4.12	1.41	0.65	0.84
Combine (A.M.)	12 ft.	4,000	1,500	13	2.53	0.87	0.52	0.64
Combine (A.M.)	6 ft.	2,150	1,500	13	1.36	0.47	0.35	0.43
Swather (P.T.)	12 ft.	825	1,300	13	0.60	0.21	0.20	0.01
Plow	4-14 in.	550	2,500	25	0.20	0.14	0.35	0.01
Plow	3-14 in.	425	2,500	25	0.16	0.11	0.30	0.01
Disk	12 ft.	825	2,000	20	0.39	0.21	0.15	0.01
Cultivator	12 ft.	425	2,000	20	0.20	0.11	0.20	0.01
Cultivator	10 ft.	350	2,000	20	0.17	0.09	0.20	0.01
Drag harrow	30 ft.	300	2,500	25	0.11	0.08	0.10	-
Drag harrow	36 ft.	325	2,500	25	0.12	0.08	0.10	-
Drill	14 ft.	850	1,500	20	0.54	0.28	0.33	0.01
Drill	12 ft.	700	1,500	20	0.44	0.23	0.33	0.01
Oneway	8 ft.	700	2,000	20	0.33	0.18	0.20	0.01
Oneway	6 ft.	625	2,000	20	0.30	0.16	0.20	0.01
Disk, single	21 ft.	500	2,000	20	0.24	0.12	0.10	0.01
Disk, double	10 ft.	375	2,000	20	0.18	0.09	0.10	0.01
Weed sprayer	30 ft.	275	1,000	20	0.26	0.14	0.30	-
								0.70

APPENDIX VII - CROP BUDGETING

The farmer who wishes to make some budget calculations can use the information contained in this bulletin as a guide. The following tables are shown as an example of how production practices, yields and prices can be used to compare production costs and returns between crops and between districts. Data from preceding tables have been used to set up these tables. Charges for land, labor and management are not included.

The farmer wishing to make comparisons for his own farm may do so by using the outline shown and inserting his own yields and prices.

Estimated costs per acre and returns per acre to land, labor and management, wheat on summerfallow, southcentral Manitoba, 1956

	: : Average for district : - dollars -	: Your estimate - dollars -
<u>Estimated costs</u>		
Land preparation:		
Summerfallow year:		
Plow	1.53	_____
Cultivate	1.67	_____
Drag harrow	0.37	_____
Crop year:		
Cultivate	1.11	_____
Drag harrow	0.36	_____
Seed	2.00	_____
Seed treatment and cleaning	0.09	_____
Seeding	0.54	_____
Weed spraying:		
Machine	0.19	_____
Spray	0.22	_____
Harvesting:		
Swather	0.42	_____
Combine	<u>2.46</u>	_____
Total costs	10.96	_____
<u>Estimated returns</u>		
Yield per acre	21 bu.	_____
Value per acre 21 bu. @ \$1.46 (av. price 1948-56)	30.66	_____
Less total costs	<u>10.96</u>	_____
Net returns	19.70	_____

Estimated costs per acre and returns per acre to land, labor and management,
barley on stubble, South-central Manitoba, 1956

		: Average for district :	: Your estimate :
		- dollars -	
<u>Estimated costs</u>			
Land preparation:			
Plow	1.53		_____
Cultivate	1.11		_____
Drag harrow	.36		_____
Seed	1.76		_____
Seed treatment and cleaning	0.09		_____
Seeding	0.54		_____
Weed spraying:			
Machine	0.19		_____
Spray	0.22		_____
Harvesting:			
Swather	0.42		_____
Combine	<u>2.46</u>		_____
Total costs	8.68		_____
<u>Estimated returns</u>			
Yield per acre	25 bu.		_____
Value per acre	25 bu. @ \$1.03	25.75	_____
	(av. price 1948-56)		
Less total costs	<u>8.68</u>		_____
Net returns	17.07		_____



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